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Short Communication

Contribution to the knowledge of urban biodiversity in Central America: A checklist to the species of Guatemala City

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Abstract

This short communication synthesizes biodiversity records of urban green spaces in Guatemala City. The research was conducted in the "Cinturón Ecológico Municipal", or "Municipal Ecological Green Belt", which consists of ravines covered with natural vegetation within Guatemala City. Available information from digital biodiversity platforms, previous studies and a short biological survey resulted in a checklist of 1688 terrestrial species, classified in 112 families of invertebrates (463 spp.), 77 families of vertebrates (348 spp.), 29 families of fungi (90 spp.), and 132 families of plants (787 spp.). A total of 113 species (7%) have some degree of vulnerability according to international and national lists of threatened species. The ongoing degradation of urban ecosystems demands urgent attention to increase biological surveys to support biodiversity conservation efforts and stricter protection measures as well as restoration of damaged areas.

Key words: Biodiversity platforms, GBIF, Portal de Biodiversidad de Guatemala, urban biodiversity, urban green

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Introduction

Central America is the second most rapidly urbanizing region in the world (Maria et al. 2017; UN 2019), making the area vulnerable to environmental degradation and local species extinctions (Simkin et al. 2022). However, some efforts have been made to preserve natural remnants in the country's capital, Guatemala City, including the delimitation of a Municipal Ecological Green Belt or Cinturón Ecológico Municipal -CEM- (in Spanish), using topographic characteristics which include multiple ravines inside and peripheral to the city (FUNDAECO 2005; Municipalidad de Guatemala 2014)

Surprisingly, since the protection of the CEM, few surveys have focused on quantifying the biodiversity in the area (Ixcot et al. 2007; García 2012), and no official checklists have been published for most of the groups (Trujillo et al.

2014; Morales-Mérida and Muller 2020; Yoshimoto et al. 2021), limiting the information available to assess protection status of local fauna, flora, and funga (CONAP 2022; IUCN 2024). Furthermore, urban ravines have many environmental problems related to inadequate water and solid waste management, and loss of forests due to formal and informal construction, which in turn threatens the habitats of multiple species (Castillo and Haase 2018). Such impacts on biodiversity have not been evaluated in urban areas of Guatemala, despite the recognized importance of biodiversity for human health, as well as cultural and economic development through various ecosystem services (Zari 2018).

Methods

To contribute to the knowledge of the biodiversity of Guatemala City, a short survey (Urban Biodiversity Project -**UBP**-) based on **IUCN** Urban Nature Indexes (IUCN 2023) was performed on six of the ravines of the **CEM** (Fig. 1), from August to November of 2023. Field observations were made during morning and night hours to search for vertebrates, and active collections were made for invertebrates and plants. Target groups for fauna included diurnal lepidoptera, arachnids, bees and wasps, birds, reptiles and amphibians. Field methods included transect surveys, entomological nets, round plots for vegetation, and non-systematic sampling. Preserved specimens were, and will be, deposited in the **USCG** Herbarium and Biological Collections of School of Biology both at Universidad de San Carlos in Guatemala City. Specimens and observations were digitized in the Guatemala Biodiversity Portal (Orellana et al. 2023) and published in **GBIF** (GBIF 2024).

Additionally, data from digital records available in the Guatemala Biodiversity Portal and the Global Biodiversity Information Facility (GBIF 2023) were consulted including records from Literature, Preserved Specimens and Observations. From these data, only records with voucher specimens and ancillary data were chosen (Troudet et.al, 2018). In the case of community science tools like iNaturalist records, only research-grade were used. The research team verified each record discarding those with incorrect identification or location. Finally, reports from previous studies were also consulted and generated a checklist of species within the limits of Guatemala City. Species records include information about means of establishments (native or introduced) derived from different biodiversity portals and specialized scientific literature for each taxon. The level of protection was identified according to international and national lists (**CITES**, **IUCN,** Guatemalan List of Threatened Species -**LEA**-). Data of species were organized using Darwin Core fields (Wieczorek et al. 2012) to facilitate consultation and mobilization. Scientific names were curated following the Guatemalan Catalog of Taxonomic Authorities (CECON 2022) for vertebrates, and the **GBIF** Backbone Taxonomy (GBIF Secretariat 2023) for other groups.

Results

A total of 1688 terrestrial species, including native (1359 spp.), migratory (85 spp.) and introduced (244 spp.) with known records for Guatemala City were included in the final checklist (Fig. 2, see Suppl. material 1). Species are classified into 112 families of invertebrates (463 spp.), 77 families of vertebrates (348 spp.), 29 families of fungi (90 spp.), and 132 families of plants (787 spp.).

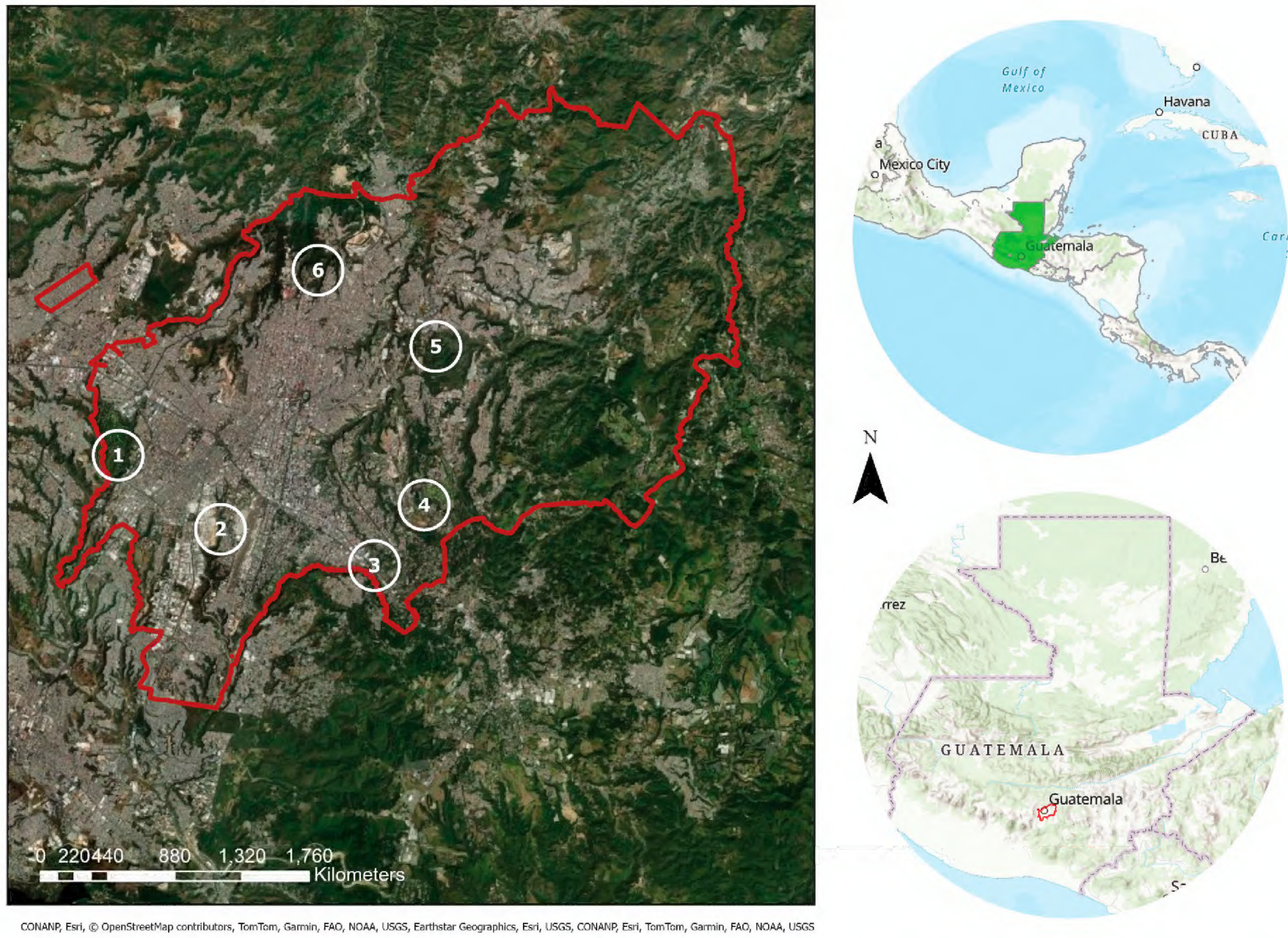

Figure 1. Localities in Guatemala City for the UBP within the CEM: 1) Guatemala Country Club 2) Pamplona Ecological Park, 3) Jungla Urbana Ecological Park, 4) Los Montañistas Park, 5) Siwan Raxché Ecological Park and 6) La Península Municipal Plant Nursery. In the upper right: Guatemala location within Mesoamerica. Lower right, Guatemala political division and Guatemala City location. Left in red: Guatemala City municipal borders.

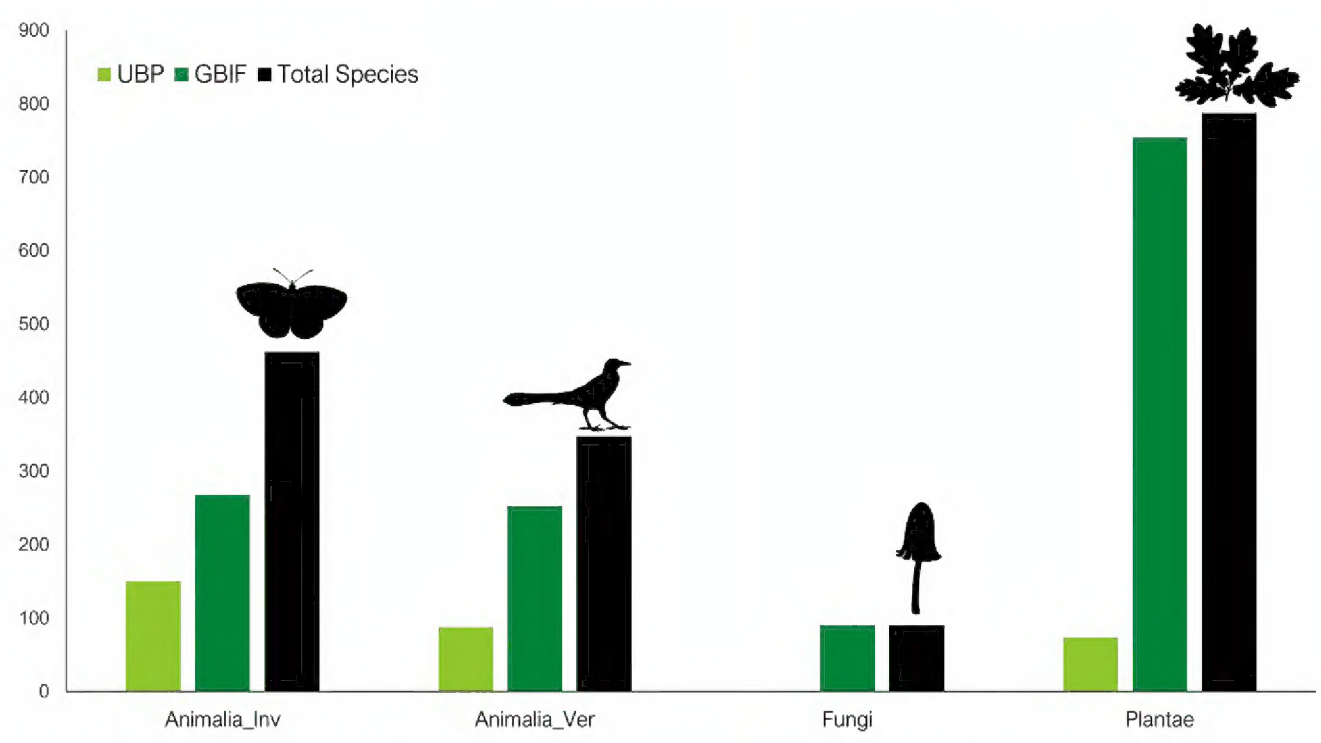

Figure 2. Known biodiversity of Guatemala City. Species of invertebrates, vertebrates, fungi and plants recorded during the Urban Biodiversity Project surveys (UBP, light green) and obtained from the Global Biodiversity Information Facility (GBIF, dark green). Total species in black. Silhouettes: PhyloPic.org.

Only a fraction of species (18%, 308 spp.) were observed or collected during the surveys of the UBP. Nearly half (41%, 694 spp.) of the species are represented only by observation records, including 173 arthropods, often difficult to identify without specimens.

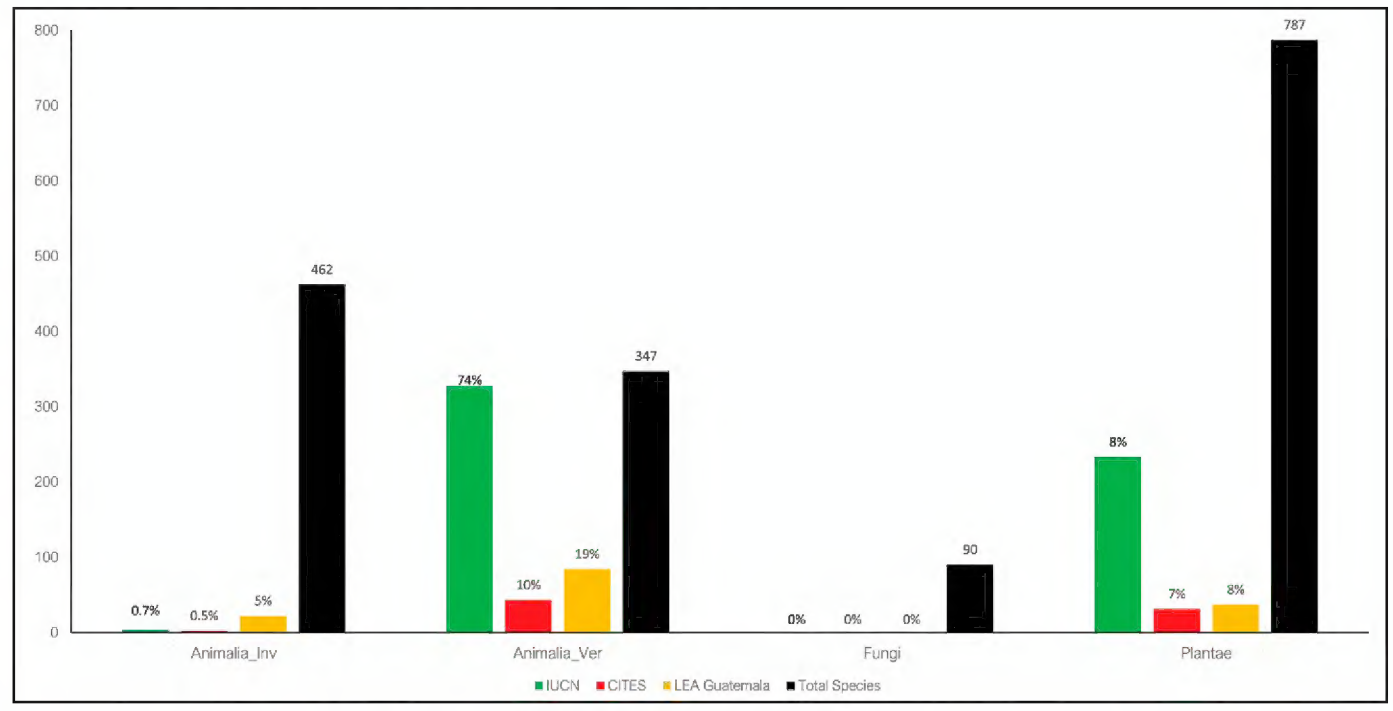

Figure 3. Percentage of species that have extinction risk assessment from IUCN and LEA or a degree of international protection from CITES. The black column represents total number of species within the taxonomic group, the yellow column the number of species and percentage in the local LEA list, the red column the number of species and percentage with some kind of degree of protection according to CITES and the green column the number of species and percentage within the IUCN list of threatened species.

At least 113 species (7%) reported in Guatemala City have some level of protection or risk, according to international (CITES, UICN) and national lists (LEA) (Fig. 3). Of these, 32 species were observed or collected during the UBP survey, including *Amazona auropalliata* (Lesson) (Aves, Psittacidae), classified as Critically Endangered (IUCN, CITES) and Endangered (LEA); *Bombus mexicanus* Cresson (Insecta, Apidae), classified as Vulnerable (IUCN, LEA); *Corytophanes percarinatus* Duméril (Squamata, Corytophanidae), *Catasticta nimbice* (Boisduval) (Insecta, Pieridae), and *Dircenna klugii* Geyer & Hubner (Insecta, Nymphalidae), classified as Endangered (LEA).

Discussion

These results emphasize the need for long-term surveys in the area to continue generating information about local species and exemplify the importance of accessible digital records for the study of biodiversity in the region. It is important to establish that this checklist does not represent a final count of species that inhabit Guatemala City, but it is only a synthesis of the species obtained during the UBP, previous studies and those represented in digital biodiversity platforms. At least 20 species recorded in previous studies (Ixcot et al. 2007) in CEM, were not found during the UBP survey or in biodiversity platforms. This may be because of sampling limitations, for example, these authors used specific methodologies for other groups, like dung beetles and Sherman-type traps for small mammals, as well as a larger sampling effort and areas outside of the municipal limits. Nevertheless, the sole results of the UBP surveys indicate the importance of the CEM for the conservation of urban species in Guatemala City, including threatened and protected taxa. These results also address urban biodiversity management as they were used to estimate Urban Nature Indexes to monitor and evaluate conservation measures' efficacy and the impact of consumption at city level (IUCN 2023).

Although digitization efforts have been made recently in national natural history collections (Orellana et al. 2023), many specimens remain inacces-

sible through digital means and it is necessary to consult the collections to search for relevant specimens. Observation platforms for community science like iNaturalist (Ueda et al. 2015) and eBird (Sullivan et al. 2009), are important complements to document groups with conspicuous characteristics (e.g. large vertebrates) but, in general, it is necessary to keep collecting specimens in the field (Troudet et al. 2018) and carefully examine preserved ones to accurately identify more challenging taxa (McMullin and Allen 2022). The field sampling effort presented here has limitations because other groups were not included in the sampling, the restricted time of sampling and because other green spaces were not sampled (e.g. cemeteries, gardens, plazas etc.).

Within Central America, cities used or are using digital biodiversity or community science platforms to estimate biodiversity indicators like San Jose in Costa Rica (https://es.shiftcities.org/), or Panama City in Panama and Managua in Nicaragua whose species are being included as projects in the iNaturalist platform (www.inaturalist.org). Recent published efforts on urban biodiversity in Central American cities also sampled field data like the flora of urban parks in two cities of Honduras (Flores et al. 2021) or bird diversity and richness in San Salvador, El Salvador (Vides-Hernández et al. 2017). This recognizes the importance of having field sampling and biodiversity digital data to complement urban biodiversity inventories and monitoring, as the first are key to evolutionary and systematics studies, and the second are gaining more important roles in the comprehension of species' response to urbanization via citizen science (Troudet et al. 2018; Callaghan et al. 2020).

A recent study by Castillo-Cabrera et al. (2021), highlights urban forests (i.e. oak-pine and dry and secondary forests) as important refuges for the survival of species, among other types of urban green spaces. Most of the remaining forests in the CEM are localized in steep ravines, which favor their conservation, but it is necessary to aim efforts to generate continuous information about the biodiversity in the area to accurately evaluate the status of the species in these urban spaces. Furthermore, it is necessary to update urban planning strategies and regulations with urban biodiversity data and prioritize environmental impact studies to guarantee the compatibility of urban development projects with the conservation of the last forest remnants in Guatemala City and surrounding areas.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

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Author contributions

FJCC: concept, visualization, manuscript draft, writing and editing; RR: data collection and review, manuscript writing and editing; MB, CLBB, ALG, MJG, HC, DT, EOA, MV, IV, AE, CLY, RMM, RBF: data collection and methodology; KSO: data review, methodology, visualization, manuscript revision and editing.

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Data availability

All of the data that support the findings of this study are available in the main text or Supplementary Information.

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Supplementary material 1

Species checklist Guatemala City

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Data type: xls

Explanation note: The total checklist of urban species in Guatemala City, and records of field work from the Urban Biodiversity Project. Including GBIF data in total checklist.

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